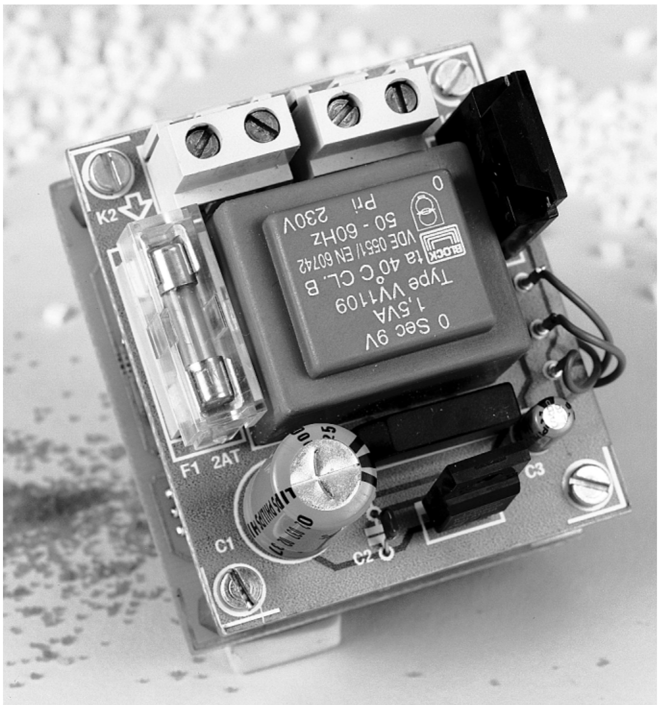
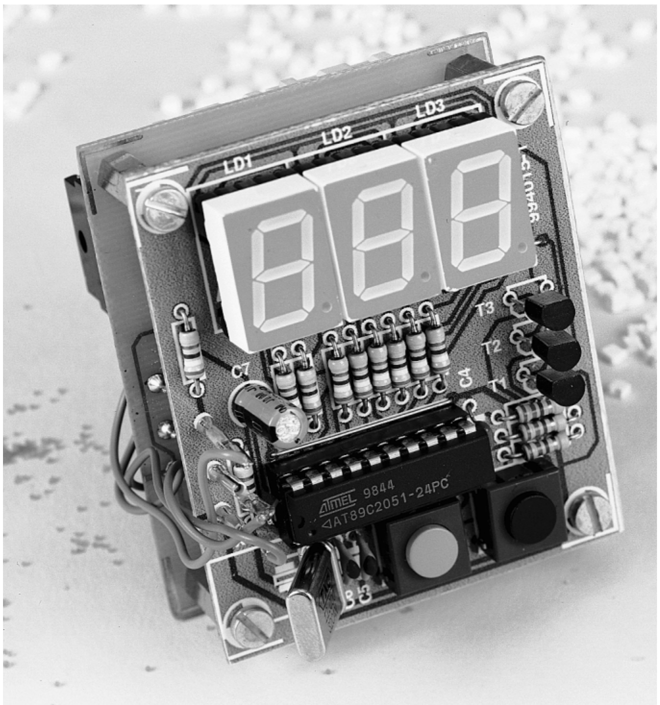
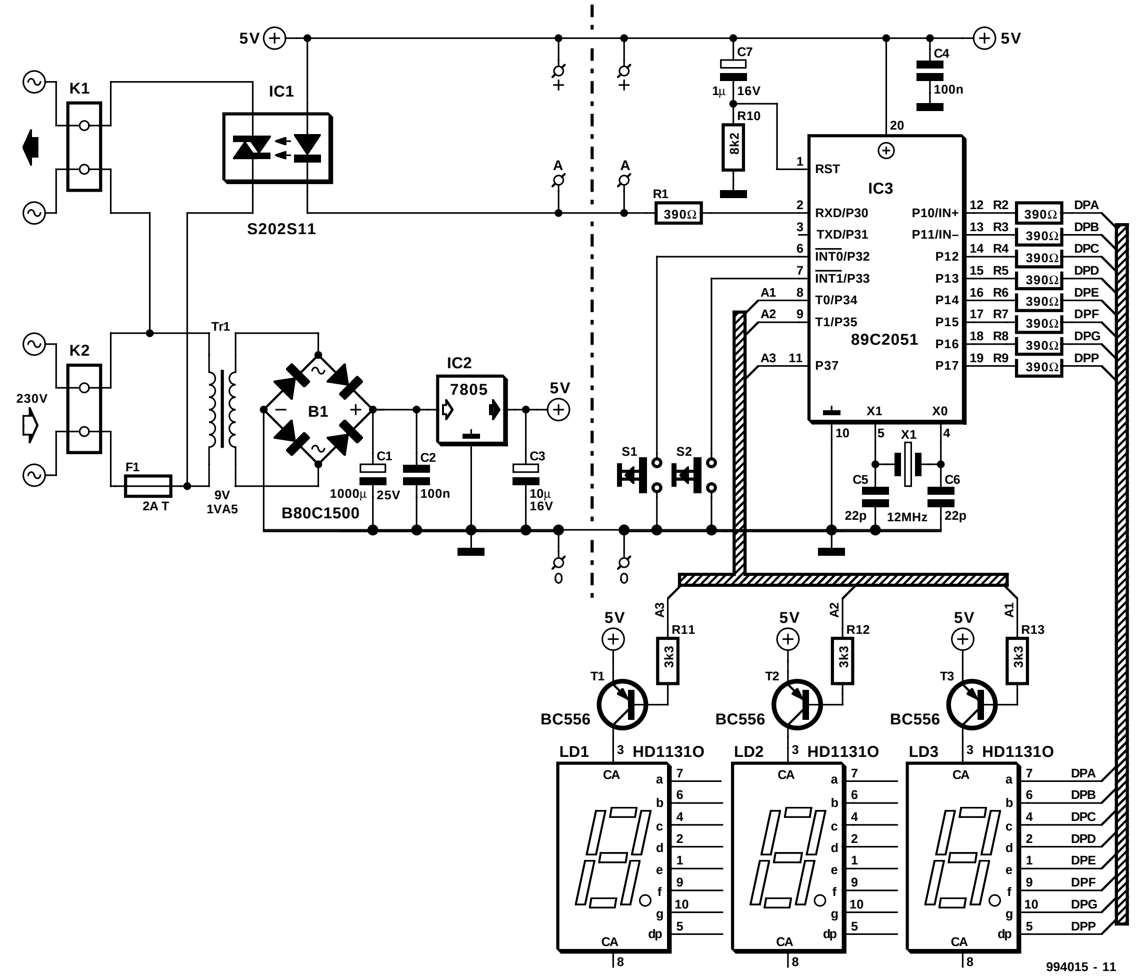
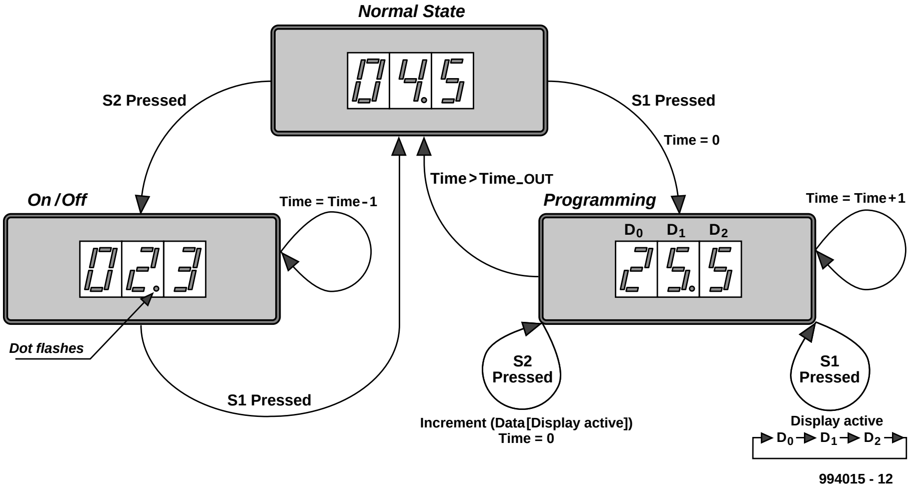
053

universal countdown timer









Design: Prof. A. Roldán Aranda

This universal countdown timer is good example of what can be achieved in terms of bare-bones hardware when using a powerful microcontroller like the AT89C2051 from Atmel. This 20-pin microcontroller has a 2-kBytes Flash ROM which is compatible with the 8051 Intel architecture. Here, the author has loaded the AT89C2051 with a program that simply eliminates a lot of hardware. The microcontroller is available ready-programmed from the Publishers.

The user interface of the timer consists of two pushbuttons and three multiplexed 7-segment LED displays. As you can see from the circuit diagram, a very small number of inexpensive external parts is required to make it all work. In order to ensure the necessary degree of electrical isolation, a solid-state relay (SSR) type S202S11 is used to control an external (mains-powered) load. This load is switched on when the timer starts, and is switched off again when the programmed time has elapsed. The maximum current that may be switched by the SSR is about 2 A.

The timer has its own mains power supply consisting of the usual elements: mains transformer (Tr1), bridge rectifier (B1) and voltage regulator (IC2). This section of the circuit may be separated from the rest by cutting the printed circuit board in two (see component overlay). Due attention should be given to electrical safety when connecting the load and all other mains wiring.

Pressing switch S1 selects the desired digit, next its value is incremented by pressing S2. The time format is [mm.s], where the seconds digit indicates tens of seconds. So, the maximum time you can set is 99.5 minutes = 99 minutes and 50 seconds. The resolution of the timer is 10 seconds, and the accuracy is derived from quartz crystal X1.

Once all digits are programmed, you have to wait until the display stops flashing (time-out for entry). Next, pressing S2 causes the load to be switched on, and the countdown operation to start. The programming of the timer is illustrated in the **state diagram**.

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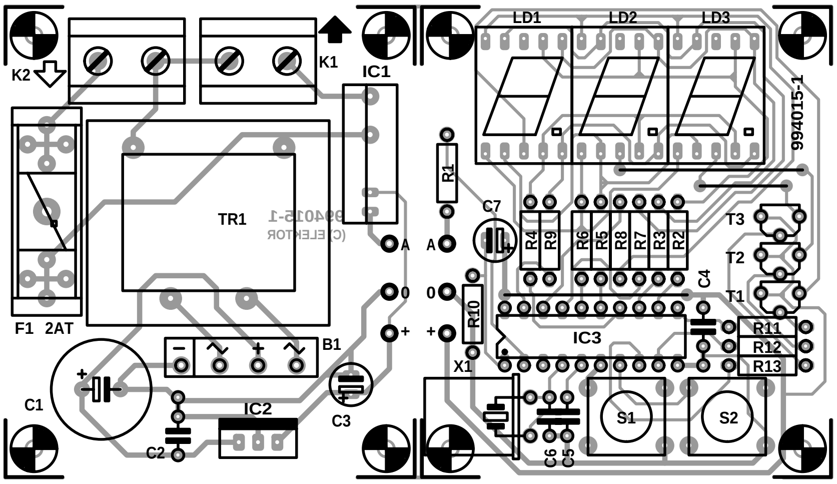

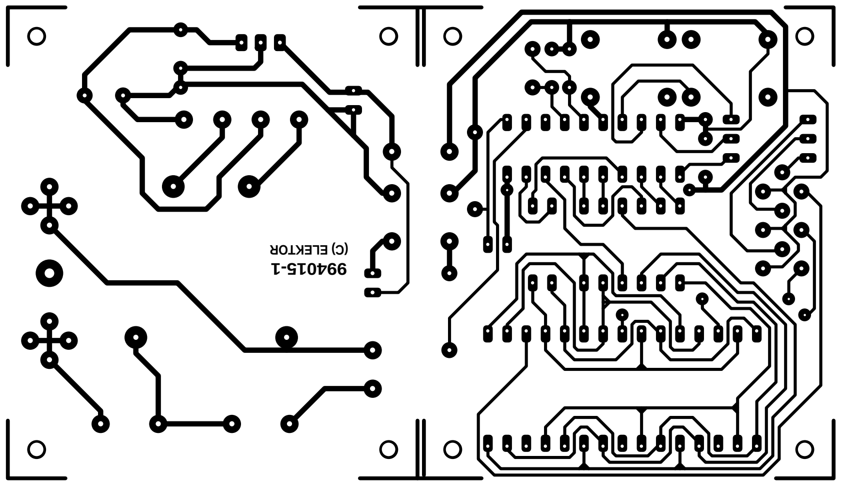

COMPONENTS LIST

Resistors:
R1-R9 = 390Ω
R10 = 8kΩ2
R11,R12,R13 = 3kΩ3

Capacitors:
C1 = 1000µF 25V radial
C2,C4 = 100nF ceramic
C3 = 10µF 16V radial
C5,C6, = 22pF ceramic
C7 = 1µF 16V radial

Semiconductors:
B1 = B80C1500 (rectangular model)
T1,T2,T3 = BC556
IC1 = S202S11 (Sharp; distributor: Eurodis)
IC2 = 7805
IC3 = AT89C2051 (programmed, Publishers order code **996511-**1)

Miscellaneous:
Tr1 = mains transformer, 9V 1.5VA, Block type VV1109
S1,S2 = pushbutton, PCB mount, MEC type 3CTL
X1 = quartz crystal, 12MHz
LD1,LD2,LD3 = HD1131O (Siemens)
K1,K2 = 2-wayPCB terminal block, pitch 7.5mm
F1 = fuse, 2A, slow, with PCB mount holder
PCB, order code **994015-1**